INCH-POUND

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25 November 2003
SUPERSEDING
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2 December 1960

DETAIL SPECIFICATION

CONNECTORS, COAXIAL, RADIO FREQUENCY, SERIES LC

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

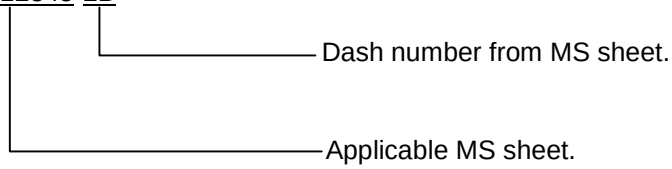
1.1 Scope. This specification covers weatherproof, series LC, radio frequency, coaxial connectors having a nominal impedance of 50 ohms (see 6.1 and 6.2).

1.2 Classification.

1.2.1 Type designation. The type designation of connectors is derived from the AN nomenclature system specified in MIL-STD-196 (see 3.1 and 6.2.)

1.2.2 Part or Identifying Number (PIN). The PIN consists of the applicable "MS" PIN.

Example: MS12345-2B



2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4 or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements cited in sections 3, 4 or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to Commander, Defense Supply Center Columbus, Attn: VAI, P.O. Box 3990 East Broad Street, Columbus, Ohio 43216-5000 or emailed to RFConnectors@dscc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST online database at www.dodssp.daps.mil.

FEDERAL SPECIFICATIONS

L-P-516	-	Plastic Sheet and Plastic Rod, Thermosetting, Cast.
O-F-499	-	Flux, Brazing, (Silver Brazing Filler Metal, Low Melting Point).
QQ-B-654	-	Brazing Alloys, Silver.

FEDERAL STANDARDS

FED-STD-H28	-	Screw-Thread Standards for Federal Services.

COMMERICAL ITEM DESCRIPTIONS

A-A-59588	-	Rubber, Silicone.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	-	Identification Marking of U. S. Military Property.
MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts.

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or www.dodssp.daps.mil or from the Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM B16	-	Rod, Brass, Free-Cutting, Bar and Shapes For Use in Screw Machines.
ASTM B36	-	Plate, Brass Sheet, Strip and Rolled Bar.
ASTM B121	-	Plate, Leaded Brass Sheet, Strip and Rolled Bar.
ASTM B124	-	Copper and Copper Alloy Forging Rod, Bar and Shapes.
ASTM B139	-	Rod, Phosphor Bronze Bar and Shapes.
ASTM B194	-	Copper Beryllium Alloy Plate, Sheet, Strip and Rolled Bar.
ASTM B196	-	Rod and Bar, Copper Beryllium Alloy.
ASTM B197	-	Wire, Alloy Copper-Beryllium.
ASTM B700	-	Electrodeposited Coatings of Silver for Engineering Uses.
ASTM D2000	-	Rubber Products in Automotive Applications.
ASTM D4976	-	Polyethylene Plastics Molding and Extrusion Materials.

(Applications for copies should be addressed to ASTM INTERNATIONAL, 100 Barr Harbor Dr., West Conshohocken, PA 19428.)

INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC CIRCUITS

J-STD-006	-	Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications, Requirements for.

(Applications for copies should be addressed to the institute for Interconnecting and Packaging Electronic Circuits, 2215 Sanders Road, Northbrook, IL 60062.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE-AS8660	-	Silicone Compound NATO Code Number S-736.
SAE-AMS-H-7199	-	Heat Treatment of Wrought Copper-Beryllium Alloys, Process for (Copper Alloys: Numbers C17000, C17200, C17300, C17500 and C17510.

(Applications for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale PA, 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet the latter shall govern.

3.2 Material. Unless otherwise specified (see 3.1), the material shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the connectors to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.2.1 Brass. Brass shall be in accordance with ASTM B16, ASTM B36, ASTM B121 or ASTM B124.

3.2.2 Copper-beryllium. Copper beryllium shall be in accordance with ASTM B194, ASTM B196 or ASTM B197. Parts fabricated of copper beryllium shall be heat treated to condition HT after machining and forming. Heat treatment shall be in accordance with SAE-AMS-H-7199.

3.2.3 Insulating and sealing compound. Insulating and sealing compound (see 3.3.3) shall in accordance with SAE-AS8660.

3.2.4 Phosphor bronze. Phosphor bronze shall be in accordance with composition A of ASTM B139.

3.2.5 Dielectric materials. Dielectric materials shall be in accordance with the following:

3.2.5.1 Polyethylene. Polyethylene shall be in accordance with ASTM D4976.

3.2.5.2 Polystyrene. Polystyrene shall be in accordance with type E-2 of L-P-516.

3.2.6 Silicone rubber. Silicone rubber shall be in accordance with class 2A, grade 50 or 60, of A-A-59588, except that the oil immersion test is not applicable.

3.2.7 Synthetic rubber. Synthetic rubber shall be in accordance with grade M4AA510B13F19 of ASTM D2000.

3.2.8 Silver solder. Silver solder shall be in accordance with class 1 of QQ-B-654.

3.2.8.1 Flux. Flux used while silver soldering shall be in accordance with O-F-499.

3.2.9 Soft solder. Soft solder shall be in accordance with composition Sn60 of J-STD-006.

3.3 Design and construction. Connectors shall be of the design, construction, and physical dimensions specified (see 3.1). Wherever feasible, parts having similar electrical characteristics may be combined (fabricated as a single piece) to simplify construction. Parts of unlike materials may be combined such as brass and copper beryllium, provided copper beryllium is used in the fabrication of the single-piece construction.

3.3.1 Metal parts. Unless otherwise specified (see 3.1), all metal parts shall have a silver plating of not less than .0002 inch (0.005 mm) thick, of sufficient smoothness and density to withstand the salt-spray (corrosion) test specified in 4.4.4. Silver plating shall be in accordance with ASTM B700. Dimensions of metal parts shall include the plating (see 3.1).

3.3.2 Screw threads. Screw threads shall be in accordance with FED-STD H28, and shall have the specified fit after plating (see 3.1).

3.3.3 Insulators. Insulators shall have no visible flaws or cracks. A coating of insulating and sealing compound (see 3.2.3) shall be applied to the insulators prior to assembly.

3.3.4 Gage tests for contacts (see 4.4.1.1).

3.3.4.1 Center contacts (female). Center contacts shall meet the gage tests specified in 4.4.1.1.1.

3.3.4.2 Outer contacts. Outer contacts shall meet the gage tests specified in 4.4.1.1.2.

3.5 Coupling nuts. After assembly, the coupling nut shall be free-finger-turning and shall not become detached from the connector body, when tested in accordance with 4.4.2.

3.4 Dielectric withstanding voltage (when applicable). When connectors are tested as specified in 4.4.3, there shall be no evidence of breakdown.

3.5 Salt spray (corrosion). When connectors are tested as specified in 4.4.4, there shall be no evidence of destructive corrosion or pitting. Destructive corrosion shall be construed as any type of corrosion, which in any way interferes with mechanical or electrical performance.

3.6 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically and advantageous life cycle costs.

3.7 Marking. Connectors shall be marked in accordance with MIL-STD-130, with the type designation and the manufacturer's code symbol. Marking shall be in depressed characters approximately .093 inch (2.38 mm) high, in the place specified (see 3.1).

3.8 Workmanship. Connectors shall be processed in such a manner as to be uniform in quality and shall be free from sharp edges, burrs, except where sharp edges are required for mechanical or electrical reasons. All solder joints shall be thoroughly cleaned.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Component-materials inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 Component-materials inspection. Component-materials inspection shall consist of verification that the component materials listed in table I, used in fabricating the connectors, are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

TABLE I. Component-materials inspection.

Component material	Requirement paragraph	Applicable specification
Brass	3.2.1	ASTM B16, ASTM B36, ASTM B121 or ASTM B124
Copper beryllium	3.2.2	ASTM B194, ASTM B196 or ASTM B197
Insulating and sealing compound	3.2.3	SAE-AS8660
Phosphor bronze	3.2.4	ASTM B139
Dielectric materials:		
Polyethylene	3.2.5.1	ASTM D4976
Polystyrene	3.2.5.2	L-P-516
Silicone rubber	3.2.6	A-A-59588
Synthetic rubber	3.2.7	ASTM D2000
Silver solder	3.2.8	QQ-B-654
Flux	3.2.8.1	O-F-499
Soft solder	3.2.9	J-STD-006

4.3 Conformance inspection.

4.3.1 Inspection conditions. Unless otherwise specified herein, all inspections shall be made at room ambient temperature, relative humidity, and pressure.

4.3.1.1 Inspection lot. An inspection lot, shall consist of all the connectors of the same type designation, produced under essentially the same conditions, and offered for inspection at one time. However, at the discretion of the Government, an inspection lot may be composed of connectors representing a number of contracts or orders and may consist of different types of connectors in any of the following combinations:

a. Types UG-155/U and UG-287/U, latest versions.
b. Types UG-208/Uand UG-216/U, latest versions.

In combination lots, the number of samples of each different type of connector taken from the lot shall be in approximately the same proportion as the number of each type making up the lot.

4.3.1.2 Resubmitted lots. If an inspection lot is rejected, the supplier may replace it with a new lot, rework it to correct the defects, or screen out the defective units, and submit it again for acceptance inspection. Resubmitted lots shall be kept separate from new lots and shall be clearly identified as resubmitted lots.

4.3.1.3 Group A inspection. Group A inspection shall consist of the examinations and test specified in table II, and shall be made on the same set of sample units, in the order shown.

TABLE II. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph
Visual and mechanical examination:		
Design and construction:		4.4.1
Metal parts	3.3.1	4.4.1
Screw threads	3.3.2	4.4.1
Coupling nuts	3.3.5	4.4.2
Marking	3.6	4.4.1
Workmanship	3.7	4.4.1
Dielectric withstanding voltage (when applicable)	3.4	4.4.3

4.3.1.3.1 Sampling plan. Table II tests shall be performed on a production lot basis. Samples shall be selected in accordance with table III. If one or more defects are found, the lot shall be screened for that particular defect and defects removed. A new sample of parts shall be selected in accordance with table III and all group A tests again performed. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

4.3.1.3.2 Visual inspection (group A inspection). Each connector shall be visually examined for completeness, workmanship, and identification requirements. Attention shall be given to those assemblies that require a gasket to determine the condition of the gasket. Gaskets missing, twisted, buckled, kinked, or damaged in any way shall be cause for rejection. Group A inspection shall be performed in any order acceptable to the Government.

TABLE III. Inspection level.

Lot size	Visual and mechanical inspection
1 to 15	All
16 to 280	20
281 to 1,200	47
1,201 to 3,200	53
3,201 to 10,000	68
10,001 to 35,000	77
35,001 to 150,000	96
150,001 to 500,000	119
500,001 to over	143

4.3.1.4 Group B inspection. Group B inspection shall consist of the examination of the physical dimensions specified on figure 1, as applicable.

4.3.1.4.1 Sampling plan. A sample of parts shall be randomly selected in accordance with table IV. If one or more defects are found, the lot shall be screened for that particular defect and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected and subjected to all tests in accordance with table IV. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification. Group B inspection shall be performed in any order acceptable to the Government.

4.3.1.4.2 Disposition of sample units. Sample units, which have passed all the group B inspection shall be delivered on the contract or order, if the lot is accepted.

4.3.1.4.3 Action in case of lot rejection. When an inspection lot is rejected on group B inspection, the supplier shall immediately investigate the cause of failure and take corrective action to assure that subsequent lots do not contain the same defect or defects.

TABLE IV. Inspection level.

Lot size	Sample size
1 to 90	5
91 to 150	11
151 to 280	13
281 to 500	16
501 to 1,200	19
1,201 to 3,200	23
3,201 to 10,000	29
10,001 to 35,000	35
35,001 to over	40

4.3.1.5 Group C inspection. Group C inspection shall consist of the examinations and tests specified in table V.

4.3.1.5.1 Sampling plan.

4.3.1.5.1.1 Subgroup 1 (unassembled connectors). Six sample units of each type connector shall be selected from initial production, and then on from each month's production in accordance with table VI.

4.3.1.5.1.1.1 Physical dimensions. To facilitate inspection of the physical dimensions, the sample units shall be divided into groups of identical piece parts. Inspection of the physical dimensions shall then be performed on a group-by-group basis.

4.3.1.5.1.1.2 Acceptance criteria. No defects shall be permitted for piece parts. In addition, no defects shall be permitted for material, plating of metal parts, and screw threads; and no failures shall be permitted in the gage tests for contacts.

4.3.1.5.1.2 Subgroup 2 (assembled connectors). Six sample units of each type connector shall be selected from initial production, and then on from each month's production in accordance with table VI. If the number of failures exceeds the applicable acceptance number specified in table VI, the sample shall be considered to have failed.

TABLE V. Group C inspection.

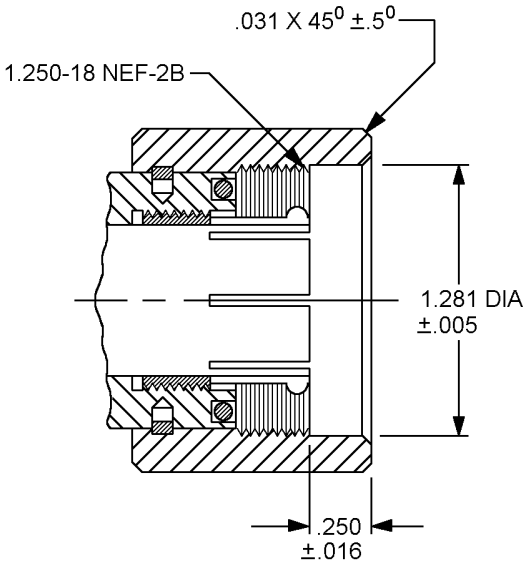
Examination or test	Requirement paragraph	Method paragraph
Subgroup 1 (unassembled connectors)		
Visual and mechanical examination		4.4.1
Material	3.1 to 3.2.9, incl	table I and 4.4.1
Design and construction		
Physical dimensions 1/	3.1 and 3.3	4.4.1
Metal parts	3.3.1	4.4.1
Screw threads	3.3.2	4.4.1
Insulators	3.3.3	4.4.1
Gage tests for contacts	3.3.4	4.4.1.1
Subgroup 2 (assembled connectors)		
Salt spray (corrosion)	3.5	4.4.4

1/ Only those dimensions related to piece parts (other than gage tests for contacts) shall be checked (see 4.3.1.5.1.1.1).

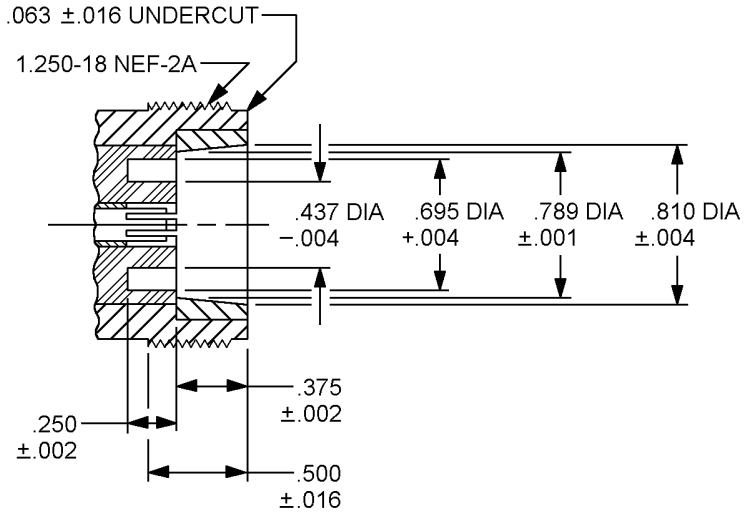
TABLE VI. Sample size and acceptance number.

		Acceptance number 1/	
Number of connectors of a given type produced during a month	Sample size	Subgroup 1	Subgroup 2
1 to 1,000 incl	2	0	0

1/ For subgroup 1, see 4.3.1.5.1.1 to 4.3.1.5.1.1.2, inclusive, for subgroup 2, see 4.3.1.5.1.2.

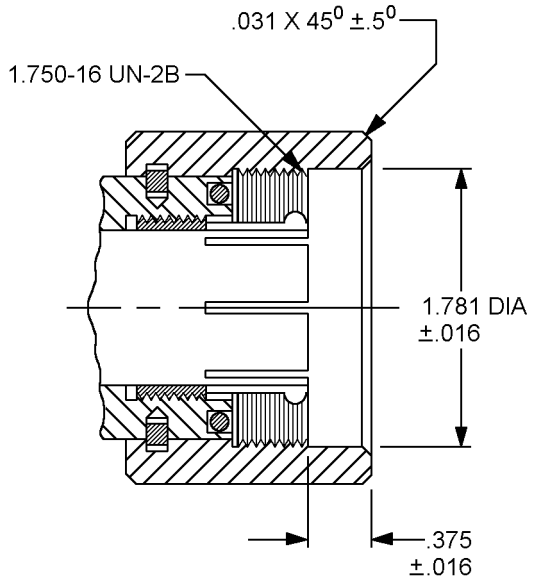


1A

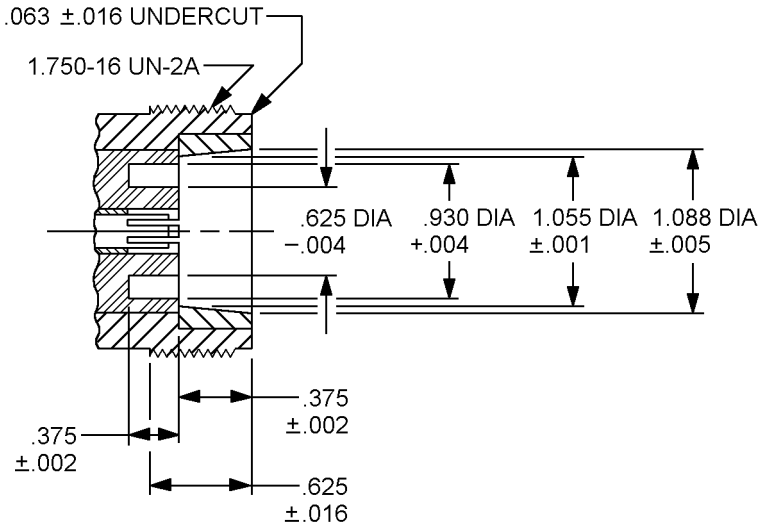


1B

FIGURE 1. Dimensional requirements for group B inspection.

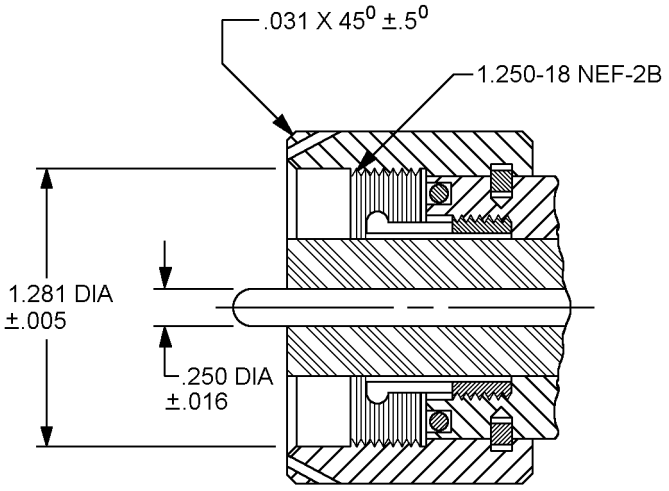


1C

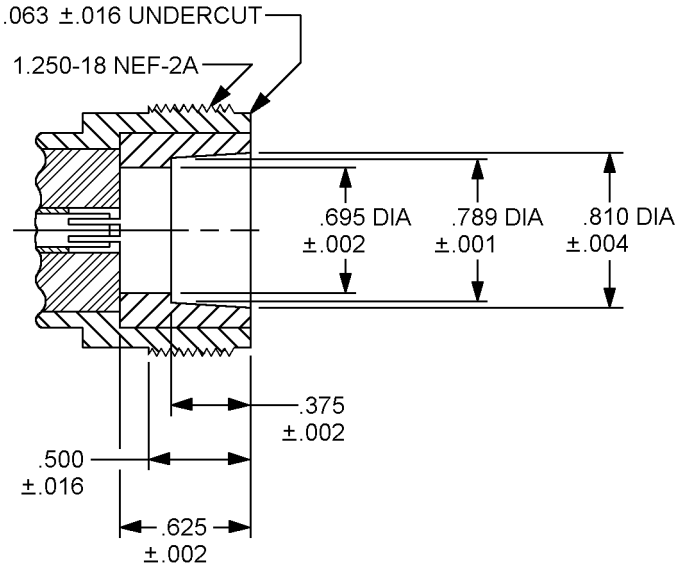


1D

FIGURE 1. Dimensional requirements for group B inspection - Continued.



1E



1F

FIGURE 1. Dimensional requirements for group B inspection - Continued.

4.3.1.5.1.2.1 Disposition of sample units. Sample units, which have been subjected to group C inspection, subgroup 2, shall not be delivered on the contract or order.

4.3.1.5.2 Noncompliance. If a sample fails to pass group C inspection, the supplier shall take corrective action on the materials or process, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Groups A and B inspection may be re-instituted, however, final acceptance shall be withheld until the group C re-inspection has shown that the corrective action was successful. In the event of failure after re-inspection, information concerning the failure and the corrective action taken shall be furnished to the contracting officer.

4.3.2 Test equipment and inspection facilities. Test equipment and inspections facilities shall be of sufficient accuracy, reliability, and quantity to permit performance of the required inspection to the satisfaction of the Government.

4.4 Methods of examination and test.

4.4.1 Visual and mechanical examination. Connectors shall be examined to verify that the materials, design, construction, physical dimensions, marking and workmanship are in accordance with the applicable requirements (see 3.1, 3.3.3, 3.6, and 3.7).

4.4.1.1 Gage tests for contacts (see 3.3.4).

4.4.1.1.1 Center contacts (female) (see 3.3.4.1).

a. Contacts mating with a .188 inch (4.77 mm) -diameter pin shall be formed in at their longitudinal centers and all contact members shall make contact with a rod .183 inch (4.65 mm) in diameter, but shall not make contact with a rod .178 inch (4.52 mm) in diameter (see 3.3.4.1).

b. Contacts mating with a .250 inch (6.35 mm) diameter pin shall be formed in at their longitudinal centers and all contact members shall make contact with a rod .254 inch (5.33 mm) in diameter, but shall not make contact with a rod .240 inch (6.10 mm) in diameter (see 3.3.4.1).

4.4.1.1.2 Outer contacts (see 3.3.4.2).

a. All fingers of the outer contacts whose nominal outside diameter is .789 inch (20.04 mm) shall make contact within .031 inch (7.87 mm) of their tip ends with a gage ring having an inside diameter of .793 inch (20.14 mm), but shall not make contact with a ring having an inside diameter of .803 inch (20.40 mm) (see 3.3.4.2).

b. All fingers of the outer contacts whose nominal outside diameter is 1.055 inches (26.80 mm) shall make contact within .031 inch (7.87 mm) of their tip ends with a gage ring having an inside diameter of 1.063 inches (27.00 mm), but shall not make contact with a ring having an inside diameter of 1.071 inches (27.20 mm) (see 3.3.4.2).

4.4.2 Coupling nuts. A pull of 100 pounds shall be applied to the coupling nut. It shall be applied in the direction away from the connector body and along the longitudinal axis (see 3.3.5).

4.4.3 Dielectric withstanding voltage (when applicable) (see 3.4). Connectors shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply:

a. Special preparations or conditions:
   (1) The maximum relative humidity shall be 50 percent. When facilities are not available at this test condition, connectors shall be tested at room ambient relative humidity. In case of dispute, if the test has been made at room ambient relative humidity, retest shall be made at 50 percent maximum relative humidity.
   (2) Precautions shall be taken to prevent air-gap voltage breakdowns.
   (3) The voltage shall be metered on the high side of the transformer.
b. Magnitude of test voltage - Unless otherwise specified, (see 3.1.), 10,000 volts root mean square.
c. Nature of potential - AC voltage.
d. Points of application of test voltage - Between the center contact and the body with the connector properly mated with its associated connector or a suitable mating jig.
e. Examination - After the test, connectors shall be examined for evidence of breakdown.

4.4.4 Salt spray (corrosion) (see 3.5). Connectors shall be tested in accordance with method 101, test condition B, of MIL-STD-202. At the conclusion of this test, the connectors shall be washed, shaken, air blasted, and then permitted to dry for 24 hours at 40°C. The connectors shall then be examined for evidence of destructive corrosion and pitting. (See 3.5.)

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Connectors covered by this specification are intended for use in radio frequency applications up to 1,000 megahertz. They are designed for use with large-size, radio frequency, coaxial cables. Their use is governed by temperature limitation of materials, and they are not recommended for use in applications where temperatures exceed 125°C.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2 and 2.3).
c. Packaging requirements (see 5.1).
d. The supplier will not substitute for a specified material or combination of fabricated parts (see 3.3) unless he obtains approval from the Government. Evidence to substantiate his claim that such a substitution is suitable and is to be submitted with his request. Similar notification and substantiating evidence will be submitted at any later time if substitution becomes necessary or desirable. At the discretion of the Government, test sample units may be required to prove the suitability of the proposed substitute.

6.3 Cross-index. This specification covers the design of series LC connectors that were previously covered by single Service drawings. Table VII is a cross-index of the connectors and single Service drawings.

TABLE VII. Cross-index of connectors and single Service drawings.

Type No.	MS Sheet or Bureau of Ships drawing No.
UG-154A/U	MS91604
UG-155B/U	REB49153
UG-156A/U	REB49154
UG-157B/U	REB49155
UG-208B/U	REB49156
UG-216B/U	REB49158
UG-219B/U	REB49159
UG-287B/U	MS91618
UG-352B/U	MS91610

6.4 Subject term (key word) listing.

Beryllium copper

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

6.6 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. Table VIII lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see 3.6).

TABLE VIII. EPA top seventeen hazardous materials.

Benzene	Dichloromethane	Tetrachloroethylene
Cadmium and Compounds	Lead and Compounds	Toluene
Carbon Tetrachloride	Mercury and Compounds	1,1,1-Trichloroethane
Chloroform	Methyl Ethyl Ketone	Trichloroethylene
Chromium	Methyl Isobutyl Ketone	Xylenes
Cyanide and Compounds	Nickel and Compounds	

CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - EC
Air Force - 11
DLA - CC

Review activities:
Army - AR, MI
Navy - AS, MC
Air Force - 99

Preparing activity:
DLA - CC

(Project 5935-4430-000)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at www.dodssp.daps.mil.